SPRAYING MACHINERY

OHIO
Agricultural Experiment Station

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BULLETIN 216

The "Old" and the "New."

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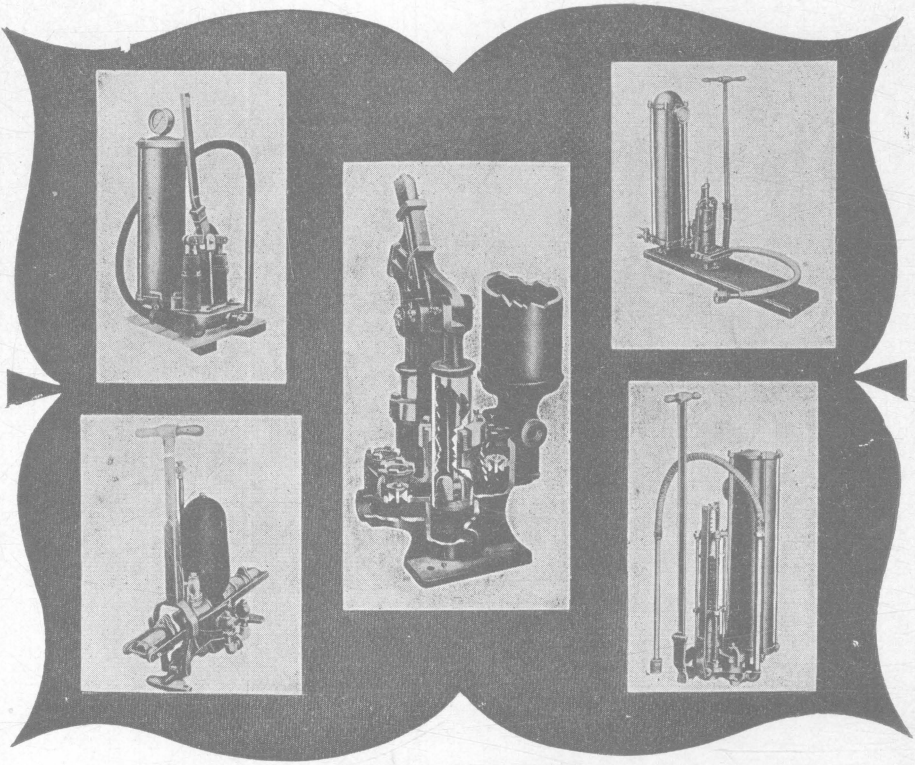


Five types of large hand pumps

Hardie
Brown

Goulds

Deming
Bean

BULLETIN

OF THE

Ohio Agricultural Experiment Station

NUMBER 216 APRIL, 1910

SPRAYING MACHINERY

By W. H. GOODWIN

Spraying machinery has become of special importance during recent years through the interest in fruit growing aroused among farmers and fruit growers in general. Experiments carried on by this Station have proved beyond a doubt that apples and other fruits of excellent quality can be profitably raised in Ohio. The unusually high price which good fruit has commanded during the past five years has tended to attract many who ordinarily would not consider orcharding as a vocation.

The fact that Ohio has a large amount of land which is unsuited to farming but will make excellent orchard land, and that the northern part of Ohio is tempered by the Great Lakes, has also stimulated fruit growers to make use of what nature has provided for them. The intense competition of the Western states in shipping fruit into a fruit-growing region and selling it where poor, home-grown fruit could not be marketed, has aroused a feeling that Ohio orchardists could raise fruit that was just as good, and they have demonstrated that this is true. These orchardists only needed to have their pride stirred up to set them at work to duplicate or excel western achievments.

Because so many people are totally unacquainted with spraying operations and spraying machinery, the preparation of this bulletin has been undertaken. It is the hope of the author that it may aid many of the uninitiated in the selection of a machine which will do what is desired of it.

Spraying machinery has been passing through a period of transition during the last decade, and pumps used for different kinds of spraying are rapidly becoming special purpose machines, designed to spray some certain crop or series of crops, which are treated in a similar manner. For example, this evolution has developed a traction machine of large capacity which will furnish liquids at high pressures to do grape, field and potato spraying thoroughly with a minimum of expense for labor and material. This is usually a two-wheeled, traction-power type of machine, in which the power is transmitted from the wheels by gears, chains, eccentrics, or cams, and the horse does the work instead of a man at the end of a pump handle.

Sometimes a man has made the acquaintance of some particular make of machine and knows its little faults so well that it may be better for him to retain this machine rather than purchase some simpler, less troublesome type of pump. On the other hand, in the present period of evolution in spraying machinery, it will often pay a man well to discard his old favorite for some more modern, more efficient type of machine which is better suited to his special line of work and better adapted to the particular conditions existing in his locality.

FACTORS TO BE CONSIDERED IN CHOOSING A SPRAY PUMP

Capacity, which involves.....	Size Weight
Simplicity, which involves ...	Accessibility of parts Ease of repair
Durability, depending upon ..	Quality of material Kind of material Workmanship Correct mechanical principles and designs Strength Weight
Cost, determined by.....	Capacity of pump Type of pump Amount of labor involved in manufacturing Material used Quality of material

Capacity. A pump of larger capacity than is actually needed will always prove more satisfactory than one which falls short of the demands made upon it. As trees and orchards increase in size, the importance of having a machine which will enable the fruit grower to cover a considerable area quite rapidly, becomes apparent. The grower must either purchase a new machine of larger capacity or look ahead at the outset, and provide for the future. Four acres of good bearing orchard is worthy of a power sprayer if the best

results are desired, and nothing of smaller capacity than a large hand pump should be considered. A larger or smaller orchard will require a pump proportionately larger or smaller, but there is a limit for even the largest machines, and twenty acres of large trees is about all one large power sprayer was ever designed to spray.

Simplicity. Spray pumps should be as simple as possible, with a minimum of parts which ordinarily require attention. These parts should be easily replaced when worn, and should not be expensive when replacement becomes necessary. The ideal sought demands, *ease of repair*, a minimum of parts, and these *readily accessible*, when worn, or not working properly. Leaky packing, clogged valves, worn out valves, valve seats, cylinder liners, and plunger packings or cups must all be considered before choosing a pump that will fulfill its mission and serve the purpose for which it was purchased.

Durability. On the *quality* and *kind* of *material*, the excellence of the *workmanship*, together with *weight* and *strength* depends the *durability* or lasting qualities of the machine. Good design is also an important factor. *Cheapness* quite often means that inferior material has been used, and that inefficient or negligent laborers, who slight their work by accident or design, have been employed in the pump's manufacture.

Designers and builders of pumps often seem unwilling to adopt new ideas or better designs, and continue to build the same type of machine that they did ten or twelve years ago. Such machines will squirt liquid after a fashion, but they do not give the purchaser the returns desired with a minimum of expense for labor and repairs.

Some machines were never intended by their designers to pump gritty spray solutions, oil emulsions, caustic solutions, or acid oils in emulsion form, and consequently will not prove satisfactory. The *efficiency* of a pump depends largely upon the construction of its valves, valve-seats, plunger, cylinder and stuffing box, if built with the last. Air chambers are also very important, hence these subjects will be taken up under separate heads.

The *body* or *frame* of the pump should be heavy and strong enough to withstand hard usage and excessive strain. Bearings are often too short, gears too narrow and too light in weight, oil cups are omitted where they are needed, and the frame upon which the machine is mounted is so light that it is warped and buckled at every stroke of the pump.

Air Chambers are often omitted on small pumps and some large machines are equipped with very small ones. A barrel pump is greatly improved by the addition of an air chamber five or six inches

in diameter and about two feet long. Intake and hose supply-pipes must be from a point near the bottom of the chamber or the value of the resilent column of air is lost. The value of an air chamber lies in the even pressure obtained, in the taking away of the heavy shock upon valves, and of the sudden strain often put on other parts of a pump. A good air chamber also eases the labor of the man at the handle of the pump or of the engine which is furnishing the power. The liquid in the air chamber is often unagitated unless some provision in design has been made so that the opening of a nozzle cut-off agitates the liquid contained in the air chamber, in addition to the agitation caused by the supply of liquid being forced into the chamber.

Cylinders. Of cylinders we have several types, but no spray pump cylinder should be made of cast iron or steel, except for spraying miscible oils and lime-sulfur solution. Brass tubing of heavy weight and threaded to fit the cylinder head is quite a common design. Some makers use a brass tubing cylinder clamped between the cylinder heads. Others use a solid cast chamber with some form of a brass liner or cylinder inside of the cast iron one. The most durable and the one least affected by spray solutions is undoubtedly the heavy, cast iron cylinder enameled with porcelain. The chief obstacle to the use of such a cylinder has been to get an even coat of enamel on the inside of the machined cylinder-casting, or a plunger-packing or cup which would have sufficient resiliency to adapt itself to the uneven wall of the cylinder. Some of the manufacturers seem to have solved this problem in a satisfactory way, while others claim it is but a partial success when used in the type of machine which they manufacture.

Valves. Kinds of valves are almost too numerous to mention if one takes into account the variations in each class. We may divide them into four classes: ball, poppet, swing-check and steam-check valves. For the first, three materials are used: rubber, steel and bronze, the latter material being of course the most durable for all-round work. Of the styles of poppet there are many which may be classified as follows: plain, square-faced poppet valves with rod-guide to hold them in position as in Fig. 1 of the plate showing valves. Fig. 2 shows how uneven is the wear on such a valve. Fig. 3 shows a plain poppet valve with wing-blades to right it instead of a rod. Fig. 5 is a bevel-faced, wing-guided poppet valve, which approaches a large ball valve in durability and efficiency, when it is made so that it will rotate. Fig. 4 shows a modified form of a wing-guided poppet valve, with a rubber or leather ring to improve its efficiency in helping to retain the liquid above it. Figs. 6, 8 and 10 are ball valves.

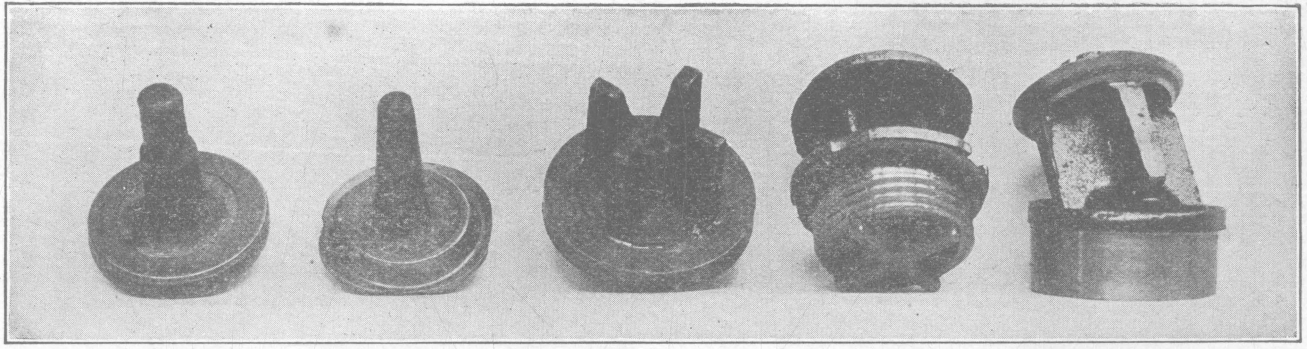


Fig. 1 Fig. 2 Fig. 3 Fig. 4 Fig. 5

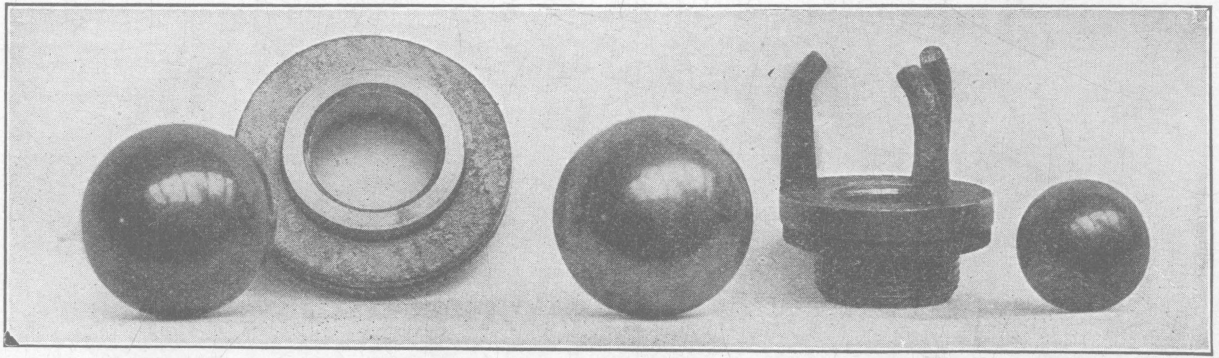
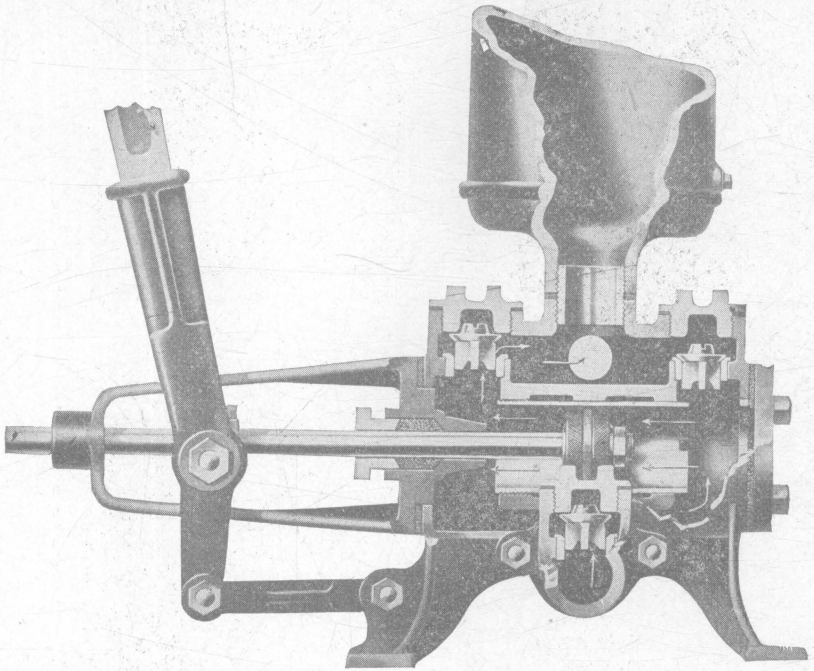


Fig. 6 Fig. 7 Fig. 8 Fig. 9 Fig. 10

PLATE SHOWING VALVES

Figs. 6 and 8, are about the desired size to give the maximum of durability and efficiency. The minimum size, shown in Fig. 10, should not be less than three-quarters inch in diameter, and the upward range may extend to one and three-eighths inch in diameter, as in Fig. 8, for the maximum size, in large power pump. Small hand pumps may have ball valves as small as one-half inch in diameter. Poppet valves should be much larger in proportion to the amount of liquid passing through them than should the brass ball-valves. It is well to remember that, when the pump is running the valve becomes as much lighter in weight as is the weight of the amount of liquid it displaces, hence a much heavier valve can be used than a novice might suppose.



Goulds double acting pump showing arrangement of parts.

Swing check and steam check valves are types designed for use in water and steam pipes. Both types work well in spray pumps when they are new, but their lasting qualities in a spraying machine are yet to be demonstrated. A flat face in any valve wears unevenly and makes a leaky valve when in combination with a flat valve-seat. Threads or waste sucked through the strainer often lodge across the square edge of the valve-seat and hold grit, hence the desirability of having bevel edges in valve-seats so that such material will not catch.

Valve Seats. Valve seats are built to receive the type of the valve used, and are made correspondingly cheap or costly. Iron valve-seats are common, and are usually found in ordinary well-pumps. Some few makers use a rubber or leather ring as a secondary seat, which prevents back flow, through its elasticity, when the weight of the liquid or the pressure above holds the valve down. One company has equipped a pump with hard rubber valve seats, but the majority of the manufacturers use a removable brass valve-seat. Strange to say, no company, as far as I know, seems to have tried to build valve-seats of the harder, non-corrodible alloys—that is, those not affected by spray solutions. In valves, a large part of the wear is on the valve-seat, especially in the case of the bronze-ball types. The ball may wear some, but constant turning keeps it a perfect sphere, while the valve-seat is hammered and worn away at every stroke of the pump, making plain the desirability of using a harder metal for a valve-seat than is used for the ball. I think that any man who has had experience with pressure pumps will also concede that a large ball-valve is the most efficient and durable type made, especially for gritty solutions such as many of the spray mixtures are known to be. Figs. 7 and 9 show valve-seats and the accompanying balls are on the left and right of the valve seats.

Plungers. Plungers are fitted with various types of packing. Very few pumps are equipped by their makers with poor packing, but leather hardens so rapidly that it is almost worthless as a packing for a spray pump, and hence should not be used for plunger-cups when other material can be obtained. The following materials are used for plunger packings: hemp, candlewicking, steam packing, paraffine canvas, cotton cloth reinforced with rubber, and various other packings which go under trade names. Most of the packings are treated with oils, graphite or paraffin, but this does not include those in which rubber has been incorporated. Plungers are usually designed to carry a special kind of packing and they work better with that kind of packing than with almost any substitute. A packing that is cheap, easily renewed or replaced, and that will last for a considerable period of time without wearing away so rapidly that it requires constant attention to keep it in shape, is the most desirable.

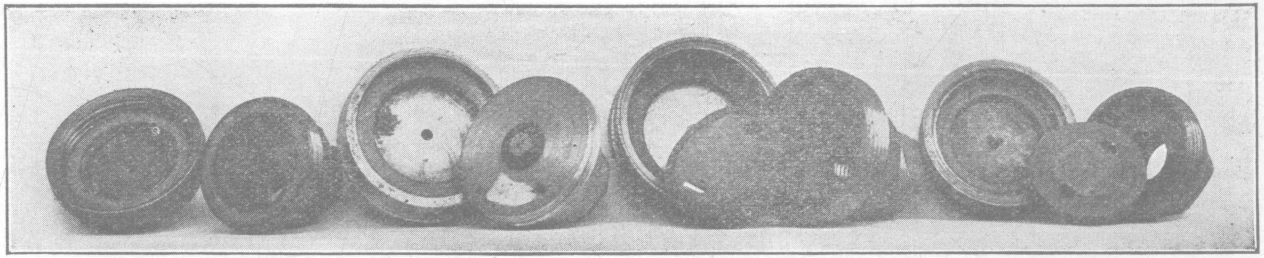
Agitators. Agitators are a frequent source of trouble in spraying outfits, especially in power machines. Swinging paddles usually pose as agitators or long rotary types are used in the bottoms of round tanks or barrels. These work very well in small tanks or barrels but are a decided failure in large tanks. The sliding agitator is the type used ordinarily in most power machines. Connections of the agitators to power are made in various ways but the principle is much the same

in different makes. The amount of power required to operate such an agitator is enormous, in proportion to the agitation one gets in an ordinary tank. Propellor agitators are much more efficient than other types because of the higher speed at which they may be run, their durability, simplicity, light weight, small size, and neat appearance, all being in their favor; besides possessing these qualities, they agitate the spray liquid thoroughly and require less power to operate them than any of the large, sliding types of equal efficiency. Jet agitators are often used on small hand pumps, but they are always inefficient and give very little agitation. A jet agitator, properly constructed would give fair agitation, but I know of none which utilizes the shape of the tank in helping to agitate the solution.

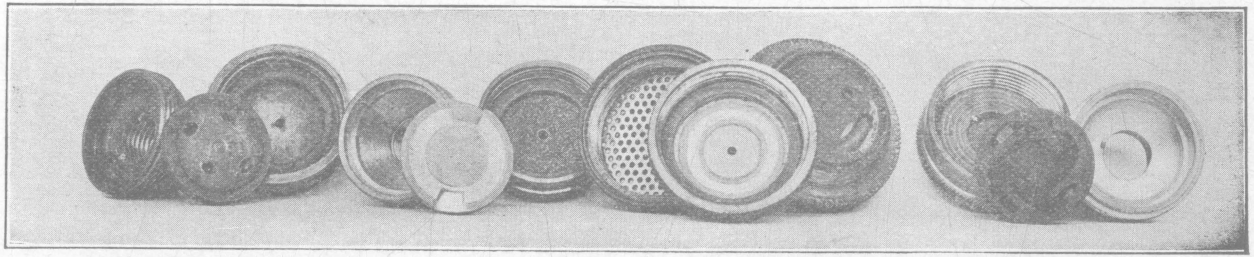
A number of hand-pumps are patterned after the ordinary water force-pump. With these the stuffing box is the source of so much friction that barrel pumps of this type should be avoided. Simpler types of pumps, without a stuffing box, should be selected. Plungers with a plunger-cup, or inside plunger-packing, require less power to operate them. Outside plunger-packing, or a stuffing-box on the outside of the plunger, is another method used in order to facilitate packing and obviate trouble. Double-acting pumps must necessarily have the stuffing box and plunger-packing too, but some of the strongest and most durable power pumps are of this type. Of the two latter types I have no particular choice, as each has its merits, and each requires about the same amount of care. The simple, single-acting pump with a plunger-cup or plunger-packing on the outside or inside, requires less attention than any of the other types and is preferable to the other types.

Supply tanks. Supply tanks are of various shapes and sizes, but the round-bottom tank is most used because it is easy to build and easily kept tight by merely tightening a few nuts on the clamp-rods. Hoop tanks always dry out and give trouble. Square, rodded tanks are very good but require more tightening of rods when they become leaky. They have some points of superiority in case the ordinary types of agitators are used, since these will agitate the solution better when it is driven into the corners of a square tank.

Nozzles. Nozzles are often a source of considerable trouble to the operator of a spraying outfit. Bordeaux nozzles throw an uneven flat spray, which is too coarse for most spraying. Vermorel types with medium caps throw a narrow-angle, fine spray, but they are of small capacity, are always catching on limbs and frequently clogging. Pressure at the nozzle-cap is also much reduced by the narrow orifices and tortuous channels through which the liquid must pass. Nozzles utilizing the principle of the whirl caused by the liquid entering from the sides of the whirling chamber, do not reduce so much the pressure



Spramotor Co's. Large Type. Friend Mfg. Co's. Aluminum Large Type. Hardie Mfg. Co's. Large Type Goulds Mistry Jr.



Goulds Mistry Jr. Four-Hole. Winkle Nozzle. E.C.Brown & Co's. Atoma Nozzle. Bean Spray Pump Co's. Large Type.

NOZZLES

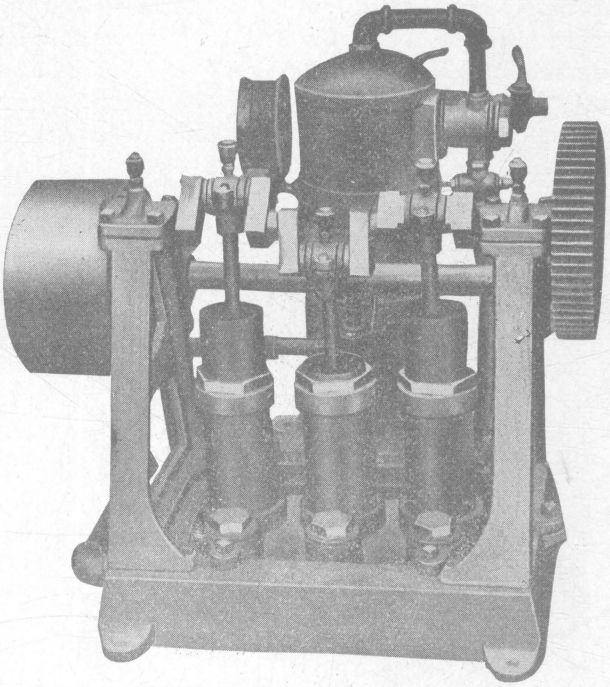
and force, and give a broader, finer spray, without reducing the speed of the liquid as it passes through the nozzle cap. They also allow the use of much larger orifices and abolish the trouble of nozzles catching on limbs. This brings us to the large types, which are made by a number of the companies and, so far as I know, all of these types of large nozzles are good.

FACTORS WHICH TEND TO MAKE A NOZZLE THROW AN EVEN SPRAY

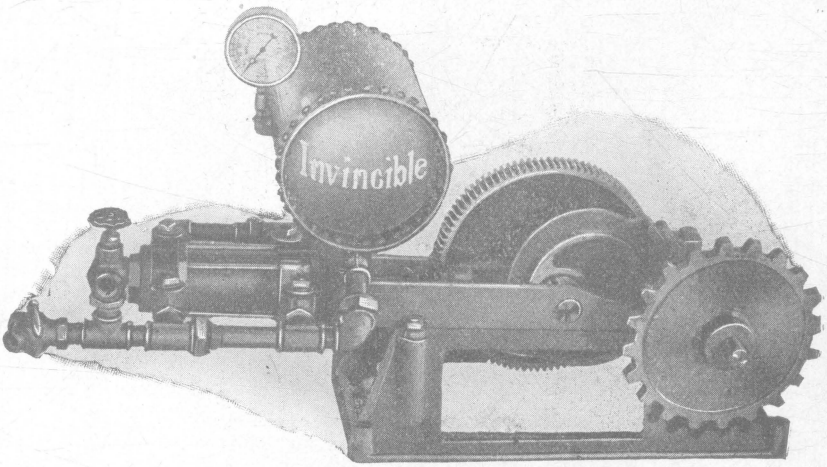
One fault that manufacturers seem to have overlooked is the tendency of the large type nozzle to throw the bulk of the spray in one quarter of the circle. This may be overcome by making more supply holes through the plate or top of the nozzle under the whirling chamber. Nozzles with four holes through the plate, instead of two, throw an almost perfectly even circle of spray. These holes make the supply of liquid come from four quadrants instead of from one or two quadrants, and even up the spray passing out through the nozzle cap. The illustration of large nozzles shows one with a four-hole supply and another with four jetties around the holes and on the sides of the whirling-chamber which give the whirl to the liquid and make a fine, even spray, especially with the high pressure obtained from power outfits. Large-type nozzles are made by the following companies:

American Sprayer Co., Minneapolis, Minn.
Bean Spray Pump Co., Berea, Ohio.
E. C. Brown Co., Rochester, New York.
Deming Co., Salem, Ohio.
Field Force Pump Co., Elmira, New York,
Friend Mfg. Co., Gasport, New York.
Goulds Mfg. Co., Seneca Falls, New York.
Hardie Mfg. Co., Hudson, Mich.
F. E. Myers & Bro.: Ashland, Ohio.
Spramotor Co., Buffalo, N. Y.
Wm. Stahl Sprayer Co., Quincy, Ill.
Geo. J. Winkle, Seneca Falls, New York.
Niagara Sprayer Co., Middleport, New York.

On an ordinary power outfit, two leads of hose should be used, a larger number seldom being of any great advantage in orchard work. The lead of hose to the man in the tower need be only fifteen feet long, while the man on the ground should have at least thirty feet, and forty feet of hose is not too much when spraying large trees. On hand- or barrel-pumps one lead of twenty-five or thirty feet in length does very well for all spraying work, or two leads of that length may be used when two men are on the ground.

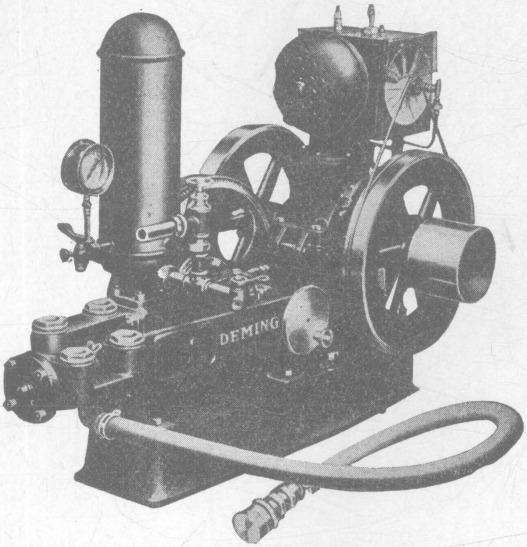


A pump which may be used with any engine of sufficient horse-power.
Hardie Mfg. Co.

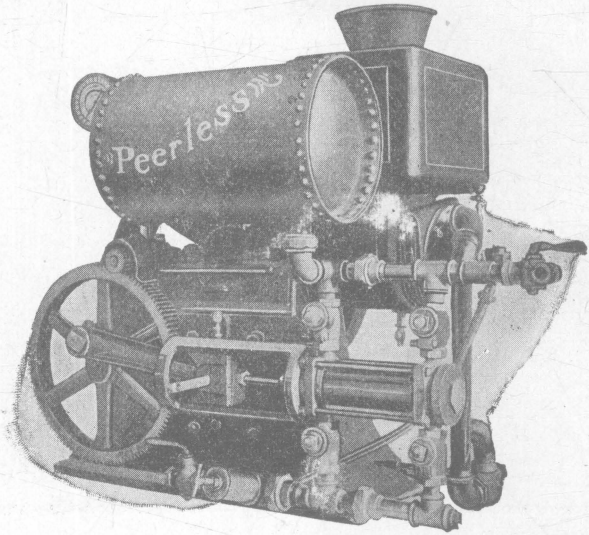


An independent pump that can be attached to any engine, **belt-drive preferable.**
American Sprayer Co

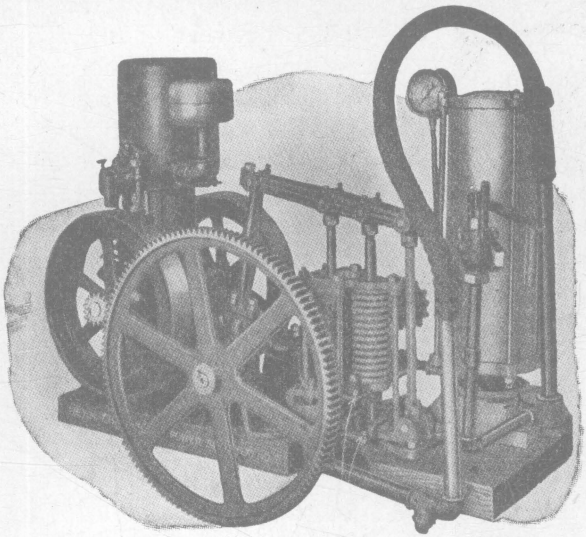
High pressure hose with long hose couplings and good hose bands are a necessity in spraying, for ordinary hose bursts under the high pressure to which it is subjected and short couplings are always making trouble. Half-inch high-pressure hose is most used, but three-eighths inch is also good and is not so heavy. The latter is harder to get connections for, when they are lost or broken, and may prove a little small in capacity when one uses three large-type nozzles on the end of a spray-rod.



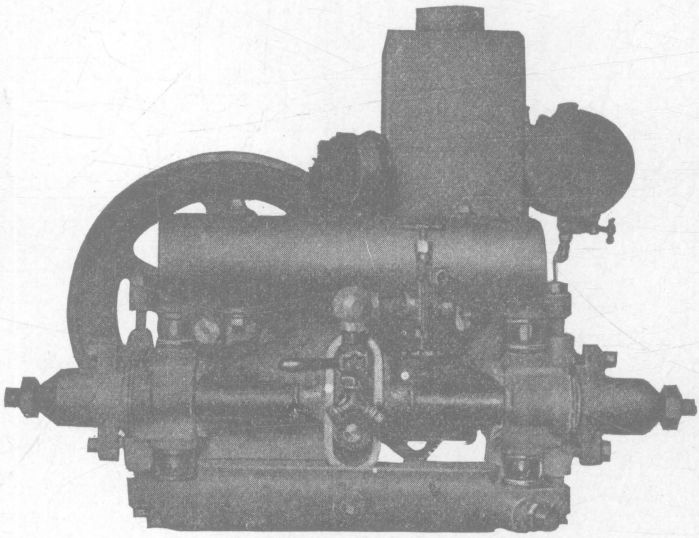
Deming double acting power pump with cast base and brass working parts.



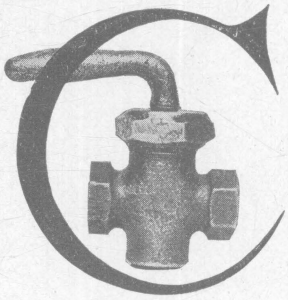
American Sprayer Co's. double-acting power pump with rod-clamped brass cylinder and brass working parts.



Bean power pump with one large diameter, single acting, porcelain lined cylinder and a patented spring attachment.

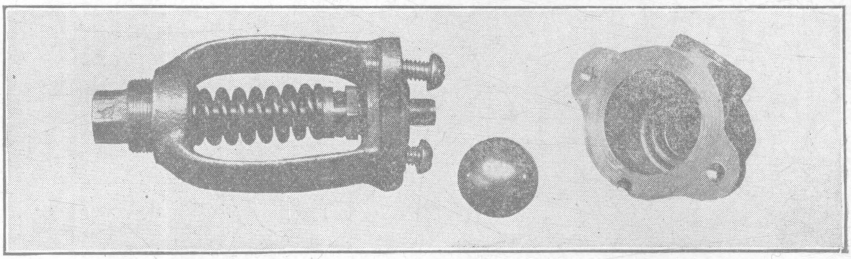


Friend power pump with two single-acting cylinders of small diamet...

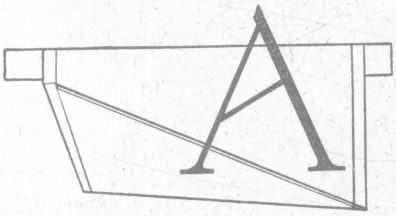


CUT-OFFS between hose and rods are of many kinds and are more often too small than too large. They are troublesome to turn when too small and soon become leaky. The box type cut-off illustrated at the beginning of this paragraph is among the best.

Rods are made of iron pipe, brass pipe, and bamboo with a brass or aluminum tube running through the hollow bamboo. Aluminum-lined bamboo rods are lighter than any of the others and when properly reinforced at the ends are as strong as any bamboo rod put out. In length the rods should not be less than eight feet. Ten-foot rods are preferable and twelve-foot rods are often a necessity in order to reach the tops of high trees. Longer rods are not often needed, and are cumbersome and hard to handle on account of their length.

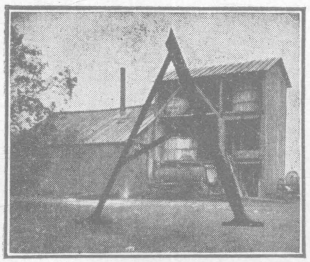


Hardie escape valve showing compressor, spring, ball, and seat. A neat, reliable and durable type of safety relief valve.



AN excellent strainer can be made by fastening a piece of fine mesh brass screening in the frame of a box and at an angle of about 30 degrees, as shown in the illustration of the initial letter of this paragraph. One end is sloped in so that the strainer may be lifted out by the end without sticking in the opening of the tank. The sloping screen is kept free from material through the action of the liquid, which is poured on the upper end of the screen and carries the material that will not pass through to the lower end. This keeps the screen clear for straining the liquid as it comes from the supply tank. This strainer may be made double by placing another similar one above the first, but with the screen sloping in an oposite direction. This is one of the simplest, most durable and efficient types of strainers, which can be easily made and repaired.

One of the necessities of the spraying business is a *good strainer*.



MOST important thing is a good, convenient mixing plant. I have not seen a half dozen good mixing-plants in northern Ohio. A good supply of water is needed. Two small sloping-end tanks for slaking lime should be set on an elevated platform high enough so that the lime will run into the mixing tank. The mixing tank should be large enough to hold almost a sprayer-tank full. The tank for copper sulphate or blue vitriol solution should be on the same platform and preferably at the same height as the lime tanks. It should be of known capacity, so that a stock solution may be readily made up. All supply tanks should be higher than the top of the sprayer tank in order to run the mixtures into it readily. The platform around the tanks should be large so that the workmen can work on at least two sides of the tank. Only the side next to the sprayer need be left off, as long lengths of hose, pipe, etc., are not then needed to reach the sprayer. Valves or cut-offs can be omitted if sections of large-diameter hose are used, and when not in use the open end of the hose may be hooked up a little higher than the top of the supply-tank. This does away with the trouble of cut-offs clogging and being eaten out by the Bordeaux, an almost certain sequence, unless they are made of brass.

When a fruit grower intends to do much spraying he should always build a mixing-plant in order to facilitate the work. The saving of time and extra labor will pay for the mixing plant in a few seasons.

ACCESSORIES

Accessories to be considered when purchasing a spray pump:

High-pressure hose.
Long hose-couplings.
Hose-bands.
Bamboo extension-rods (brass or aluminum lined) or pipe extension rods.
Cut-offs (between rods and hose) preferably of the box type.
Three-way cut-offs.
Suction hose.
Pressure gauge.
Nozzles.
Drip guards.
Y's and angle-elbows for nozzles.
Strainers.
Hose-reducers.
A mixing plant.
Escape valve.

COST OF SPRAYING

The cost of labor for a single spraying, basing the price at $1.50 per day for a man, 75 cents for a boy, and $1.50 per day for a team, is given in a table following this paragraph. Higher wages will increase the cost proportionately. The cost per tree varies with the capacity of the machine, the size of the trees, convenience of mixing

plant and distance from orchard to filling station. As much time must be allowed for filling as for spraying out a tankful of solution, and often one must add twice as much time for filling and mixing as for emptying. These estimates are for labor only, and do not include the cost of spraying materials. For details concerning materials and methods of application see Bulletins 191 and 199 and Circular 95.

LARGE POWER OUTFITS

Capacity, 1200 to 1600 gallons per day.
Rated capacity, 7 to 11 gallons per minute at 200 pounds pressure.
Number of trees sprayed per day, 100 to 200, according to the size of the trees.
Three men and one team needed.
Actual cost of labor, 1 cent per minute for a 10-hour day.
Time used, 2 to 6 minutes per tree.
Cost per tree, 2 to 6 cents.

SMALL POWER OUTFITS

Capacity, 800 to 1100 gallons per day.
Rated capacity, 4 to 7 gallons per minute at 150 to 175 pounds pressure.
Number of trees sprayed, 60 to 120 per day.
Two men, one boy, one team.
Actual cost of labor, .875 cents per minute.
Average time per tree, 5 to 12 minutes.
Cost per tree, 4 to 11 cents.

LARGE HAND SPRAY PUMPS

Capacity, 600 to 800 gallons per day.
Rated capacity, 3 to 5 gallons per minute at 125 pounds pressure.
Number of trees sprayed, 40 to 80 per day.
Three men, one team.
Actual cost of labor, 1 cent per minute.
Average time per tree, 6 to 15 minutes.
Cost, 6 to 15 cents per tree.

LARGE BARREL PUMPS

Capacity, 400 to 700 gallons per day.
Rated capacity, 2 1-2 to 4 gallons per minute at 125 pounds pressure.
Number of trees sprayed, 25 to 50 per day.
Three men, one horse.
Actual cost of labor, .875 cents per minute.
Average time per tree, 10 to 20 minutes.
Cost per tree, 8 to 18 cents.

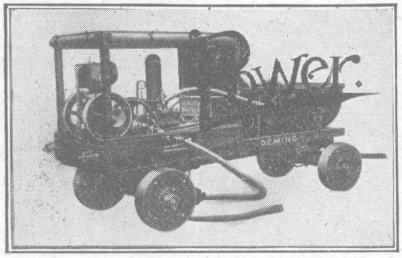
MEDIUM BARREL PUMPS

Capacity, 300 to 500 gallons per day.
Rated capacity, 1 1-2 to 2 1-2 gallons per minute at 125 pounds pressure.
Number of trees per day, 18 to 30.
Two men, one horse.
Actual cost of labor, .625 cents per minute.
Average time per tree, 18 to 36 minutes.
Cost per tree, 12 to 22 cents.

SMALL BARREL PUMPS

Capacity, 150 to 200 gallons per day.
Rated capacity, 1 to 1 3-4 gallons per minute at 125 pounds pressure.
Number of trees per day, 10 to 20.
Two men, one horse.
Actual cost of labor, .625 cents per minute.
Time per tree, 25 to 45 minutes.
Cost, 14 to 28 cents per tree.

SPRAYING OUTFITS



SPRAYING outfits are briefly described in the following list:

American Sprayer Co. An orchard traction outfit of large capacity. Peerless outfit, two models of nearly same weight. Sliding agitator, Wallace water cooled engine, 2 to 3 H.P. and double acting pump with swing check valves and a patent pressure regulator. Large air chamber, half round-bottom tank, fairly short-coupled trucks.

Invincible outfit, air cooled engine and Wallace Invincible pump. Other details similar to Peerless outfit.

Bean Spray Pump Co. The Challenge. A low, strong outfit of medium weight and large capacity, large porcelain lined cylinder, single acting pump with large bronze-ball valves. A type of propellor agitator, large air-chamber, water-cooled engine, 2 1-2 H.P. Short-coupled trucks, rectangular tank.

Deming Co. Premier outfit, large, very heavy and strong, of large capacity. New Way air-cooled engine, 2 1-2 or 3 1-2 H.P., sliding agitator, fairly long-coupled trucks, large air-chamber and double-acting pump with large ball valves. Half-round bottom tank.

Deming power outfit. Smaller and lighter than the Premier outfit but of large capacity. 1 1-2 H.P. water-cooled engine, pump, tank and trucks similar to the Premier outfit.

Cushman Power Sprayer Co. Three models, light outfits, medium and large capacity, Cushman water-cooled two cycle engine, 3 H.P. Duplex or triplex pumps, bronze ball valves, propellor agitator, round steel tanks, large wheeled, short coupled, strong trucks.

Olds Gas Power Co. Same as Deyo in most respects.

Goulds Mfg. Co. Like a Deyo outfit or a New Way outfit. Air-cooled engine 2 1-2 and 3 to 3 1-2 H.P. Goulds Vice Admiral pump, large air-chamber, wing-guided bevel-face poppet valves, sliding agitator, fairly short-coupled trucks, low and strong, half-round bottom tank.

Hardie Mfg. Co. Hardie Triplex, Light outfit, large capacity. Ideal water-cooled engine, 3 H.P., belted to Triplex pump. Ball-valves in pump, large air-chamber, half-round bottom tank, short-coupled trucks, sliding agitator.

Simplex outfit. Large and medium capacity, two sizes. Ideal water-cooled engine, 1 1-2 or 3 H.P., Simplex twin-cylinder pumps, similar to Triplex in other details.

Hardie No. 2. A light outfit, medium capacity. Ideal engine, 1 1-2 H.P., belted to pump-jack. Hardie pump, double-acting. It is without trucks and has a paddle agitator.

R. H. Deyo & Co. Deyo outfit. Heavy outfit of large capacity. Olds air-cooled engine, 2 1-2 to 3 H.P., Goulds Vice Admiral pump with large air-chamber, wing-guided bevel-faced poppet valves, sliding agitator, half-round bottom tank, fairly short-coupled trucks.

Fairbanks Morse Co. Very heavy outfit, large capacity, water-cooled engine.

Field Force Pump Co. Leader outfit, a heavy machine, large capacity, water-cooled engine, 3 1-2 H.P., sliding agitator, medium sized air-chamber, low, short-coupled trucks. Wheels with very broad tires. Half-round bottom tank.

Friend Mfg. Co. Friend regular model. Light outfit, large capacity. Friend air- or water-cooled engine, 2 1-2 to 3 1-2 H.P. New Friend pump, medium sized air-chamber, large ball-valves, half-round bottom tank, short-coupled trucks, large wheels with broad tires. Propellor agitator.

Friend Hilly Orchard. Similar excepting trucks, which have very large wheels in rear, with tank between them and small wheels in front which cut under and make an outfit which can be turned in a small area.

Spramotor Co. Light outfit, large capacity. Duplex pump, water-cooled engine, 1 1-2 H.P. Ideal engine, 2 1-2 H.P. or air-cooled engine. Sliding agitator, half-round bottom tank. Outfit has recently been revised and may be changed somewhat from the one described.

International Harvester Co. A heavy outfit of large capacity, with water-cooled engine and a double-acting pump.

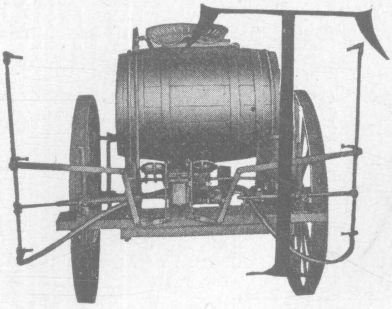
A lighter outfit of medium weight with an air-cooled engine, a double-acting pump, and a sliding agitator.

New Way Motor Co. A heavy outfit of large capacity. New Way air-cooled engine, Goulds, Deming or Myers double-acting pump. Half-round bottom tank, sliding agitator.

Binks Spraying Machine Co. Power outfit, medium weight. Water-cooled engine, double-acting pump. Sliding agitator, half-round bottom tank.

Power outfits should be chosen according to capacity and simplicity. Weight is a factor to be determined by the orchardist. His orchard may be hilly or level, and the size of trees and the kind of usage a machine is to get will determine what sort of an outfit to purchase. Extremely light outfits, in most cases, are not as durable as the slightly heavier types. Weight and strength have been sacrificed for lightness, but the durability of such an outfit is in some few makes of machines nearly equal that of the heaviest types. Type of pump, valves, etc., also figure largely in durability, but most of the leading pump manufacturers use bronze-ball or bevel-faced wing-guided poppet valves, so this factor does not enter so largely in the choice of a pump. *Capacity*, *simplicity*, *efficiency*, *durability* and *cost*, are the factors one must consider. Choose preferably a close-coupled truck, with fairly large wheels in the rear and smaller wheels in front, all wheels with broad tires, and with the spraying machine frame set low, using the wagon without a bolster in the rear, if possible, but with the machine set level.

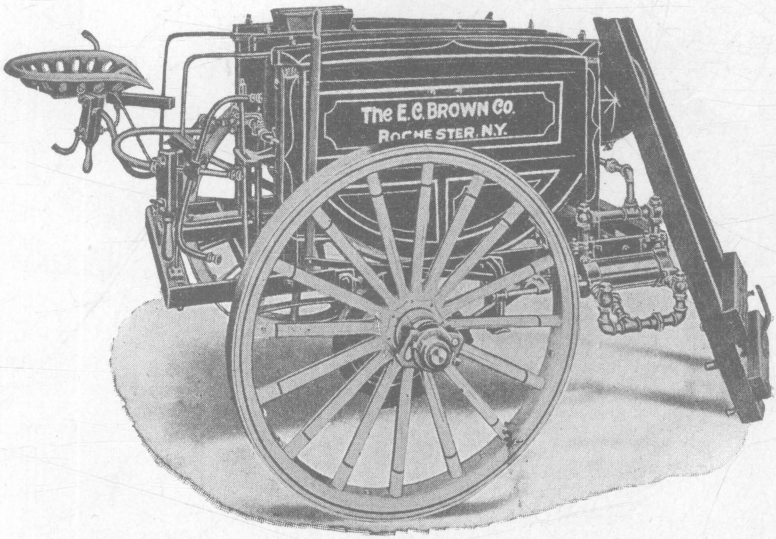
Home-made power outfits are not advisable, as very few have the facilities for connecting up pump and engine satisfactorily. Special purpose machines may be built at home, and also a good hand or independent power pump outfit may be readily assembled.



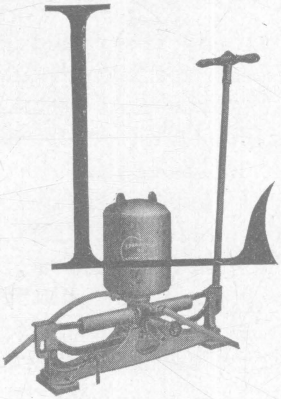
RACTION-POWER sprayers are for the most part, special purpose machines. There are a few machines of this type built for orchard spraying but most of them were designed for spraying grapes, potatoes and similar field crops, or spraying for the destruction of weeds. Power is transmitted from the wheels by means of cams, eccentrics, chains or gears, and the pump is operated by these various mechanical contrivances. Here, as in the case of other types, the same factors, *strength*, *simplicity*, *durability* and *capacity*, must be considered.

Traction machines were designed as special purpose machines, and are not a complete success for orchard spraying. Some few machines can be operated as hand pumps as well as used as traction machines.

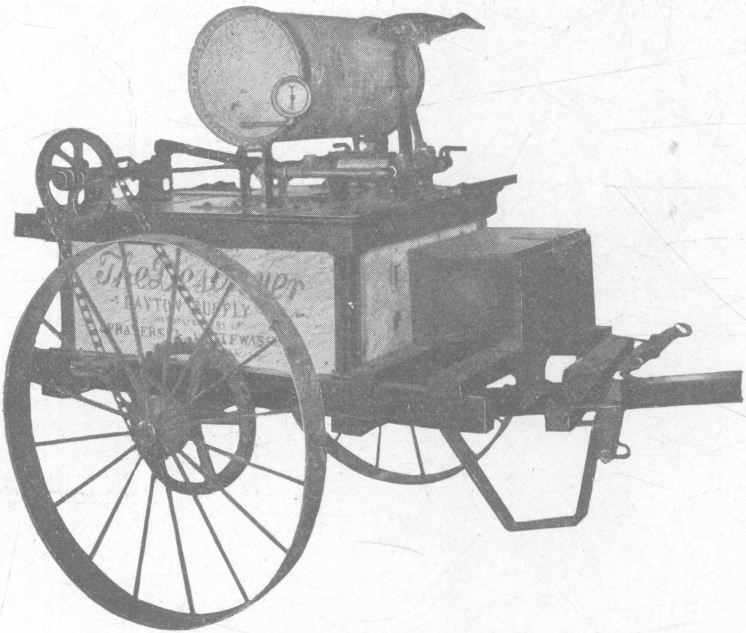
For the man who has a small orchard and needs a field sprayer, some machine of this type should be selected; but the fruit grower who has a large orchard must look to the other types for a more suitable machine.



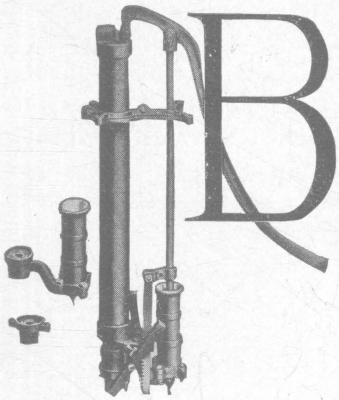
A traction sprayer with double-acting pump operated by an eccentric.



LARGE hand pumps approach small power-machines in capacity and are better than any barrel pumps on account of the long leverage that can be used. Two cylinders of smaller diameter are often used and the capacity is then greatly increased over that of the ordinary barrel pump. The entire weight of the body can be applied to the lever without stooping or bending the back, while any type of a tank or barrel can be used as the spray liquid container. For the man who cannot afford a power sprayer, or who has a medium sized orchard and can get cheap labor, this style is very satisfactory.

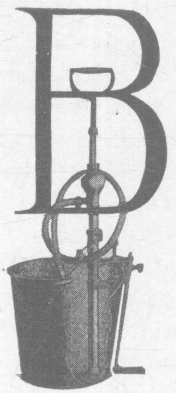


A traction sprayer with a double-acting chain driven pump.

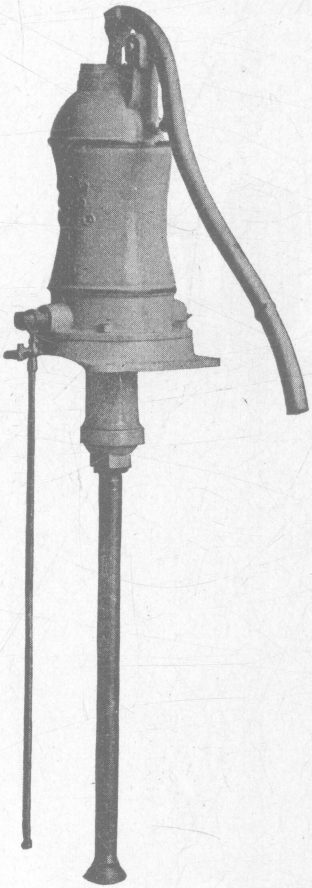


BARREL pumps of medium capacity are well suited to the small fruit grower or farmer who does not care to invest much money and yet wishes to raise good fruit. Medium capacity barrel pumps are to be preferred before the large capacity barrel pumps because the latter are hard to operate and it takes a heavy, strong man to pump one all day. Besides being useful for the man with a small home orchard, they may be successfully used for cold water painting, whitewashing, spraying chicken coops to destroy mites, lice, etc.

A barrel pump with valves, plunger and packing readily accessible.



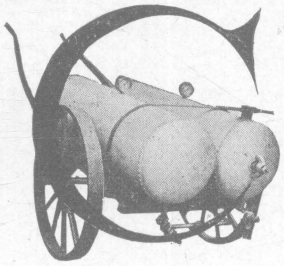
BUCKET pumps were never designed for spraying the apple orchard, but they are convenient for spraying truck crops, small trees and bushes around the yard, chicken coops, and doing many other small jobs about the home, where a small convenient pump is needed. The Knapsack pump is a portable type of bucket pump, very useful for small work, and for spraying truck and garden crops.



A barrel pump with plumbing connections and parts not readily accessible.

AUTOMATIC sprayers are more convenient than knapsack sprayers, for they may be filled and then pumped up with air and the entire attention of the operator can be devoted to spraying without having to do the double duty of pumping and spraying at the same time. They are very convenient and readily carried about. For truck crops they are hard to beat when they are *well made*.

A fault of the larger part of the sprayers of this type is that they are made of galvanized iron and are corroded so rapidly by the Bordeaux sprays that they become worthless in a year or two. To be durable they must be constructed of heavy sheet brass, preferably seamless or with well riveted joints. For small work, a well made sprayer of this type is almost ideal.



COMPRESSED air sprayers have some advantages, since they are easily operated and are of very simple construction. For such outfits the first cost of the charging and mixing plant and of the sprayer tanks is somewhat greater than that of the average power outfit having an equivalent daily capacity, so far as the amount of liquid sprayed out is concerned. The pressure, when using a compressed air sprayer, must vary between two extremes, usually from 160 to 80 pounds while the tankful of solution is being discharged. This tends to make the work uneven, since the quality of the spray varies from fine to coarse and there is also a variation in the amount of liquid discharged in a given time. On the other hand, power outfits are operated under an almost constant pressure which is often as great as 200 pounds to the square inch.

Considering these facts, and also that the amount of skilled labor required to operate either outfit is practically the same, I have reached the conclusion, after having operated both types of outfits in the field, that for the average orchardist, a power outfit is superior to the compressed air outfit.

In either case the operator must possess average mechanical ability and exercise reasonable care.

Sprayers using compressed gas have the disadvantage of decomposing the lime-sulfur sprays. For killing scale insects, lime-sulfur spray is one of the best, and is almost universally used in orchard work.

Dust sprayers have been successfully used in treating cotton, tobacco and a few similar field crops. In general orchard work they have not proved a success, as has been demonstrated in extensive competitive tests against liquid sprayers. However they have shown merit for such special use as dusting orange groves for rust mite. Their range of usefulness is evidently quite restricted.

In the following tables I have attempted to list the manufacturers who make various kinds of machines, so that an intending purchaser may write to those companies which build the kind of a machine he wishes to purchase, for catalogues and prices of the same.

Companies making Independent pumps to which power can be adapted:

American Sprayer Co., Minneapolis, Minn.
Bean Spray Pump Co., Cleveland, Ohio.
The Deming Co., Salem, Ohio.
Field Force Pump Co., Elmira, N. Y.
Goulds Mfg. Co., Seneca Falls, N. Y.
Hardie Mfg. Co., Hudson, Mich.
F. E. Myers & Bro., Ashland, Ohio.
Spramotor Co., Buffalo, N. Y.

Companies manufacturing traction machines for grape, potato and field spraying, but sometimes adapted for use in orchards:

American Sprayer Co., Minneapolis, Minn.
E. C. Brown Co., Rochester, N. Y.
Dayton Supply Co., Dayton, Ohio.
Field Force Pump Co., Elmira, N. Y.
Goulds Mfg. Co., Seneca Falls, N. Y.
Hardie Mfg. Co., Hudson, Mich.
H. L. Hurst Mfg. Co., Canton, Ohio.
Latham & Co., Sandusky, Ohio.
Spramotor Co., Buffalo, N. Y.
Wm. Stahl Sprayer Co., Quincy, Ill.

Companies manufacturing large capacity hand pumps:

Bean Spray Pump Co., Cleveland, Ohio.
E. C. Brown Co., Rochester, N. Y.
The Deming Co., Salem, Ohio.
Field Force Pump Co., Elmira, N. Y.
Friend Mfg. Co., Gasport. N. Y.
Goulds Mfg. Co., Seneca Falls. N. Y.
Hardie Mfg. Co., Hudson, Mich.
F. E. Myers & Bro., Ashland, Ohio.
Spramotor Co., Buffalo, N. Y.
Wm. Stahl Sprayer Co., Quincy, Ill.

Companies manufacturing large capacity barrel pumps, the rated capacity of which is over two and one-half gallons per minute:

American Sprayer Co., Minneapolis, Minn.
Field Force Pump Co., Elmira, N. Y.
Goulds Mfg. Co., Seneca Falls, N. Y.
Hardie Mfg. Co., Hudson, Mich.
Latham & Co., Sandusky, Ohio.
Morrill & Morley, Benton Harbor, Mich.
Spramotor Co., Buffalo, N. Y.
Wm. Stahl Sprayer Co., Quincy, Ill.

Companies manufacturing medium and small capacity barrel pumps.

American Sprayer Co., Minneapolis, Minn.
Barnes Mfg. Co., Mansfield, Ohio.
Bean Spray Pump Co., Cleveland, Ohio.
E. C. Brown Co., Rochester, N. Y.
Dayton Supply Co., Dayton, Ohio.
Deming Co., Salem, Ohio.
Field Force Pump Co., Elmira, N. Y.
Friend Mfg. Co., Gasport, Ohio.
Goulds Mfg. Co., Seneca Falls, N. Y.
Hardie Mfg. Co., Hudson, Mich.
H. L. Hurst Mfg. Co., Canton, Ohio.
Latham & Co., Sandusky, Ohio.
F. E, Myers & Bro., Ashland. Ohio.
Spramotor Co., Buffalo, N. Y.
Wm. Stahl Sprayer Co., Quincy, Ill.

Companies manufacturing Kerowater or Kerosene mixing sprayers:

Dayton Supply Co., Dayton, Ohio.
Deming Co., Salem, Ohio.
Goulds Mfg. Co., Seneca Falls, N. Y.
Spramotor Co., Buffalo, N. Y.

Companies manufacturing Knapsack sprayers:

Barnes Mfg. Co., Mansfield, Ohio.
Deming Co., Salem, Ohio.
Field Force Pump Co., Elmira, N. Y
Goulds Mfg. Co., Seneca Falls, N. Y.
F. E. Myers & Bro., Ashland, Ohio.
Spramotor Co., Buffalo, N. Y.
Wm. Stahl Sprayer Co., Quincy, Ill.

Companies manufacturing bucket pumps:

American Sprayer Co., Minneapolis, Minn.
Barnes Mfg. Co., Mansfield, Ohio.
Bean Spray Pump Co., Cleveland, Ohio.
E. C. Brown Co., Rochester, N. Y.
Dayton Supply Co., Dayton, Ohio.
Deming Co., Salem, Ohio.
Field Force Pump Co., Elmira, N. Y.
Goulds Mfg. Co., Seneca Falls, N. Y.
Hardie Mfg. Co., Hudson, Mich.
H. L. Hurst Mfg. Co., Canton, Ohio.
F. E. Myers & Bro., Ashland, Ohio.
Wm. Stahl Sprayer Co., Quincy, Ill.

Companies manufacturing automatic sprayers:

American Sprayer Co., Minneapolis, Minn.
Bean Spray Pump Co., Cleveland Ohio.
E. C. Brown Co., Rochester, N. Y.
Dayton Supply Co., Dayton, Ohio.
Field Force Pump Co., Elmira, N. Y.
Hardie Mfg. Co., Hudson, Mich.
H. L. Hurst Mfg. Co., Canton, Ohio.

Companies manufacturing compressed air sprayers:

American Horticultural Distributing Co., Martinsburg, W. Va.
Latham & Co., Sandusky, Ohio.
Niagara Sprayer Co., Middleport, N. Y.
Pierce-Loop Co., Northeast, Pa.

Companies mancfacturing dust sprayers:

Dust Sprayer Co., Kansas City, Mo.
Leggett & Bros., New York, N. Y.

Companies assembling or manufacturing spraying machines:

American Sprayer Co., Minneapolis, Minn.
Barnes Mfg. Co., Mansfield, Ohio.
Bean Spray Pump Co., Cleveland, Ohio.
Binks Spraying Machinery Co., Chicago, Ill.
Cushman Power Sprayer Co., Lincoln, Neb.
E. C. Brown Co., Rochester, N. Y.
Dayton Supply Co., Dayton, Ohio.
Deming Co., Salem Ohio.
R. H. Deyo & Co., Binghamton, N. Y.
W. & B. Douglas, Middleton, Pa.
Fairbanks, Morse & Co., Cleveland, Ohio.
Field Force Pump Co., Elmira, N. Y.
Friend Mfg. Co.; Gasport, N. Y.
Gilson Mfg. Co., Port Washington, Wis.
The Goulds Mfg. Co., Seneca Falls, N. Y.
The Hardie Mfg. Co., Hudson, Mich.
Hurst Mfg. Co., Canton, Ohio.
International Harvester Co., Local agencies.
Latham & Co., Sandusky, Ohio.
Morrill & Morley, Benton Harbor, Mich.
F. E. Myers & Bro.. Ashland, Ohio.
The New Way Motor Co., Lansing, Mich.
Niagara Spraying Co., Middleport, N. Y.
Olds Gas Power Co., Lansing, Mich.

Pierce-Loop Co., Northeast, Pa.
Spramotor Co., Buffalo, N. Y.
Wm. Stahl Sprayer Co., Quincy, Ill.

In the following tables machines manufactured by the various companies are listed. The first column gives the name of the pump, the second, the kind of pump, the third, the capacity of the pump per minute, as the companies approved of or sent as correct at the pressure indicated in the fourth column, and the speeds given in the sixth column. The fifth column gives the estimates at the same speed and pressures as the companies capacities were given, but using the actual amount of liquid displaced per minute by the plunger. This does not allow for leaky valves, plunger-packing or jet agitators, so it is a little high in every case. Column seven gives the type of valves used in the pump; columns eight and nine, the length of stroke and diameter of the cylinders; column ten, the additional remarks upon the various types of pumps.

AMERICAN SPRAYER COMPANY

Name	Kind of machine	Companies capacities Gallons	Pressure Lbs.	Estimated capacities Gals.	Speed in strokes per minute	Type of valves	Length of stroke Ins.	Diameter of cylind'r Ins.	Remarks
Peerless	Power	8 to 11	200	8 to 12	50 strokes	Swing check	4	3	Double acting, rod clamped, brass cylinder with stuffing box.
Invincible	Indpt. power	7 to 9	200	7 to 9	"	"	3	3	" "
Standard	Traction	20	125	18	250 feet per	"	8	3	" "
Wallace Jr.	"	14	125	12	"	"	3	3	" "
Wallace Field	"	15 1-2	125	13	"	"	4	4	" "
Wallace Potato	"	10	125	9	"	"	3	3	" "
Wallace Grape	"	10	125	9	"	"	3	3	" "
Eureka No. 4	Barrel	1 to 1 1-4	125	1 to 1 3-4	30 strokes	"	4, 4 1-2	2	Single acting, brass cylinder, inside plunger packed.
Eureka No. 5	"	2 to 2 1-2	125	2 to 2 1-2	"	"	4 1-2, 5	2 1-2	" "
Eureka No. 6	"	3 to 4	125	3 to 4	"	"	4 1-2, 5	2 3-4	

BARNES MANUFACTURING COMPANY

Perfection	Bucket	1 1-2	50	1	30 strokes	Rubber ball	17	1	
Double Acting	Barrel	1 1-2 to 2	125	1 1-2 to 2	"	Poppet	3 1-4	2 1-2	A double acting pump with brass cylinder and
New Improved	"	2 to 2 1-2	125	2 to 2 1-2	"	"	4	2 1-2	with a small reversed brass cylinder and
Perfection	Bucket-barrel	1 to 1 1-4	125	1 to 1 1-4	"	Rubber ball	5 1-2	1 1-4	plunger above doing away with a stuffing box
Fig. 256		2 per	125	2 per	"	Bronze "	12	1 1-4	

BEAN SPRAY PUMP COMPANY

Challenge	Power	6 to 7	200	6 to 8	50 strokes	Bronze ball	4	3	Single acting, porcelain lined cylinder packing is a rubber composition cup.
Power	Indpt. power	10 to 11	200	10 to 12	"	"	4	3	
Torrent	Hand	5 to 5 1-2	125	5 to 5 1-2	30 strokes	"	4	2 1-2	
Magic No. 9	"	3 to 4	125	3 to 4	"	"	4 1-2	3	
Magic No. 10	"	2 to 3	125	2 to 3	"	"	4 1-2	2 1-2	
Nos. 7 and 6	"		125		"	"			
Junior No. 1	"	2 to 3	125	2 to 3	"	"	4	2 1-2	
No. 70	Barrel	1 1-2 to 2	125	1 1-2 to 2	"	"	3 1-2	2 1-4	
No. 60	"	1 1-2 to 2	125	1 1-2 to 2	"	"	3 1-2	2 1-4	

E. C. BROWN COMPANY

Name	Kind	Companies capacity Gallons	Pressure Lbs.	Estimated capacities Gallons	Speed in strokes per minute	Type of valves	Length of stroke Ins.	Diameter of cylind'r Ins.	Remarks
Auto Spray No. 24	Barrel	1 1-2 to 2	125	1 1-2 to 2	30 strokes	Steam	4	2 1-4	Outside packing, single action pump, plunger of hollow tube type, two cylinders, single acting, with packing on outside of plunger. All double acting stuffing box types of cylinders with cylinder tubes held in place by rods clamping on the cylinder heads.
" " 7	Hand	4 to 6	125	4 to 6	"	check	5	2 1-4	
" " 11	Traction	5 to 6	125	5 to 6	Calculated	valves in	6	2 1-2	
" " 15	"	5 to 6	125	5 to 6	that horse	all but	6	2 1-2	
" " 23	"	10 to 11	125	10 to 11	travels at	Auto Spray	6	2 1-2	
" " 27	"	5 to 6	125	5 to 6	250 feet per	30 and No.	6	2 1-2	
" " 28	"	10 to 11	125	10 to 11	minute	2 Bucket,	6	2 1-2	
" " 29	"	10 to 11	125	10 to 11	under	which have	6	2 1-2	
" " 31	"	10 to 11	125	10 to 11	ordinary	ball valves.	6	2 1-2	
" " 32	"	5 to 6	125	5 to 6	conditions.		6	2 1-2	
" " 33	"	10 to 11	125	10 to 11			6	2 1-2	

DAYTON SUPPLY COMPANY

Climax No. 1.....	Barrel	.9	125	.9	30 strokes	Poppet	5	1 1-4	Stuffing box, single acting valve in plunger types like well pumps
" " 2.....	"	1.6	125	1.6	"	"	5	1 1-2	
" " 3.....	"	2 to 2 1-4	125	2 to 2 1-4	"	"	5	2	
Destroyer.....	Traction	6 to 8	125	6 to 8	250 feet per	P & B check	5	2 1-2	Double acting stuffing box, rod clamped cylinder types.
Dolphin.....	"	3 to 4	125	3 to 4	minute for	"	5	1	
Orchard	"		125		traction	"			
Economy	Bucket	1	125	1	types				

THE DEMING COMPANY

Premier	Power	7 to 10	200	8 to 9	50 strokes	Bronze ball	4	2 1-2	Stuffing box double acting type, with brass cylinder inside of cast iron frame. The Premier power and Independent power are built with crossheads and guides. Canvas cups or rubber composition cups used on plungers.
Power	"	7 to 9	150	6 to 8	"	"	4 1-2	2 1-2	
Bonanza Power....	"	4 to 5	200	4 to 5	"	"	3 1-2	2	
" "	"	8 to 9	200	8 to 9	"	"	4 1-2	2 1-2	
Indpt. Power.....	Indpt. power	7 to 10	200	8 to 9	"	"	4 1-2	2 1-2	
Sampson	Hand	3 to 5	125	3 to 5	30 strokes	"	3	2 1-2	No stuffing box, small reversed plunger above.
Bonanza 1	"	2 to 3	125	2 to 3	"	"	3 1-2	2	Similar to power pumps in construction.
" 2	"	4 to 5 1-2	125	4 to 5 1-2	"	"	4 1-2	2 1-2	" "
Century 1.....	Barrel	1 1-2 to 2	125	1 1-2 to 2	"	"	4 1-2	1 3-4	Single acting pumps without a stuffing box.
" 2	"	2 to 2 1-2	125	2 to 2 1-2	"	"	4 1-2	2 1-4	" "
Granger	"	1 1-2 to 2	125	1 1-2 to 2	"	"	4 1-2	1 3-4	Single acting, inside plunger packing.
Simplex	"	2 to 2 1-2	125	2 to 2 1-2	"	"	4 1-2	2 1-4	Single acting, stuffing box type.
Captain	"	1 1-2 to 2	125	1 1-2 to 2	"	"	4 1-2	1 3-4	Single acting, inside plunger packing.
Gem Jr	"	3-4 to 1	125	3-4 to 1	"	"	4	1 1-2	Single acting, stuffing box type.
Bucket	Bucket	3-4 to 1	125	3-4 to 1	"	"	15	1	

FIFLD FORCE PUMP COMPANY

Name	Kind	Companies capacities Gallons	Pressure Lbs.	Estimated capacities Gallons	Speed in strokes per minute	Type of valves	Length of stroke Ins.	Diameter of cylind'r Ins.	Remarks
Leader	Power	7 to 10	200	7 to 10	50 strokes	Poppet	5	2 1-2	Double acting pumps with stuffing box.
"	"	8 to 12	200	9 to 12	"	"	5	3	" " "
Ideal	Indpt. Power	12	200	9 per	"	"	4	2 1-2	" " "
Admiral	Hand	10 to 11	125	5 to 7	30 strokes	"	5	2 1-2	" " "
Empire Queen	Barrel	2 to 3	125	1 1-4 to 2	"	"	3 to 4	2	Single acting pump with a stuffing box.
Empire King	"	3 to 6	125	2 1-2 to 3 1-4	"	"	3 to 4	2 1-2	" " "
Jr. Empire King	"	2 1-2 to 5 1-2	125	2 to 3	"	"	3 to 4	2 1-2	" " "
Niagara Hydraulic	Hand	3 to 6	125	2 to 3 1-4	"	"	4	2 1-2	" " "
Victor	Traction	10 to 12	125	6 to 9	250 feet per	"	3	2, 3	" " "
Wooster	"	5 to 8	125	4 to 5	"	"	3	1, 3	" " "
Watson	"	6 to 10	125	5 to 6	"	"	3	2 1-2	" " "
Wild Rose	"	10 to 12	125	6 to 9	"	"	3	3	" " "
Aroostook	"	10 to 12	125	6 to 9	"	"	3	3	" " "
Eagle	Barrel	3 to 6	125	2 to 3 1-4	30 strokes	"	4	2 1-2	Single acting pump without a stuffing box.

FRIEND MANUFACTURING COMPANY

Friend	Power	7 to 8	200	7 to 8	50 strokes	Ball	3 1-2	2	Cylinder, outside plunger packed, single acting.
Friend Jr	Barrel	2	125	2	30 strokes	"			

GOULDS MANUFACTURING COMPANY

Triplex	Power	8 to 10	200	8 to 10	50 strokes	Bevel-faced	3 1-2		
Vice Admiral	"	7 to 8	200	7 to 8	"	wing-	4 1-2	2 1-2	The Admirals are double acting pumps, brass
" "	"	8 to 10	200	8 to 10	"	guided	4 1-2	3	lined cylinders, with a stuffing box.
Emperor	"	6 to 8	200	6 to 8	"	poppet	4	2 1-2	Emperor and Monarch have single acting double
"	"	4 to 6	200	4 to 6	"	valves.	4	2	cylinders with outside plunger packing.
Monarch	Hand	4 to 5	125	4 to 5	30 strokes		4	2 1-2	
"	"	3	125	3	"		4	2	
Pomona	Barrel	2 to 3 1-4	125	2 to 3 1-4	"		3, 4 or 5	2 1-2	Barrel pumps are single acting and all are
Savelot	"	2 to 3 1-4	125	2 1-2 to 3 1-4	"		3, 4 or 5	2 1-2	without stuffing boxes.
Fruitall	"	1 1-2 to 1 2-3	125	1 1-2 to 1 2-3	"		4	2	
Standard	"	2 1-4 to 3 1-4	125	2 to 2 1-2	"		3 1-2	2 1-2	
Premier	Bucket	1	125	1	"				
Admiral	Hand	5	125	5	"		4 1-2	2 1-2	
"	"	7	125	7	"		4 1-2	3	
Standard	Barrel	2 1-2 to 3 1-4		2 1-2 to 3 1-4	"		3 1-2	3	

HARDIE MANUFACTURING COMPANY

Name	Kind	Companies capacities Gallons	Pressure Ins.	Estimated capacities Gallons	Speed in strokes per minute	Type of valve	Length of stroke Ins.	Diameter of cylind'r Ins.	Remarks
Triplex	Power	5 to 8	200	5 to 7	50 to 80	Bronze ball	2 3-4	2	All power machines excepting No. 2 have outside plunger packing, single acting cylinder types.
Simplex C	"	7	200	7	50 strokes	"	3 1-2	2 1-2	
Simplex D	"	5 1-2	200	4 1-2	"	"	3 1-2	2	No. 2 double acting pump with cylinder threaded to receive the cylinder heads.
No. 2	"	4 to 5	175	4 to 5	"	"	5	1 5-8	
Twin cylinder	Hand	3 to 3 1-2	125	3 to 3 1-2	30 strokes	"	3 1-2	2	Outside plunger packing, 2 single cylinders.
No. 4½	Barrel	2-3	125	2-3	"	"	3 1-2	1 5-8	Inside plunger packed, single acting pumps without a stuffing box.
No. 5	"	1 1-3	125	1 1-3	"	"	4	1 6-8	
No. 6	"	2	125	2	"	"	5	2	
No. 7	"	4	125	4	"	"	5	2 1-2	" "
Bucket	Bucket	1-2	125	2-3	"	"	5	1 1-4	

H. L. HURST MANUFACTURING COMPANY

Fitzall	Barrel	1 1-2 to 1 3-4	125	1 1-2 to 1 3-4	30 strokes	Bronze ball	4 1-2	2 1-4	Single acting outside plunger, packed pumps.
Hurst	Traction	4 to 5	125	4 to 5	250 feet per	"	4	2 1-2	

LATHAM & COMPANY

Latham 3	Barrel	1 to 1 1-2	125	1 1-2 to 2	30 strokes	Poppet	3 to 5	2	Single acting without a stuffing box.
" 4	"	2 to 2 1-2	125	2 to 3 1-4	"	"	3 to 5	2 1-2	A unique type.

MORRILL & MORLEY

Barrel	Barrel	2 to 3	125	2 to 3	30 strokes	Poppet	3 to 4	3	Single acting, inside packed plunger.

F. E. MYERS & BROTHER

Name	Kind	Companies capacity Gallons	Pressure Lbs.	Estimated capacity Gallons	Speed in strokes per minute	Type of valves	Length of stroke Ins.	Diameter of cylind'r Ins.	Remarks
Pitman Power.....	Power	7 to 10	200	7 to 10	50 strokes	Poppet	5	2 1-2	Double acting pump with stuffing box and brass lined cylinder.
" "	"	5 to 7	200	5 to 7	"	"	5	2	
Back Geared		6	200	6					
Hydraulic	Hand	3 1-4	125	3 1-4	30 strokes	"	4 1-2	2	These pumps are without a stuffing box and have a reversed plunger in the double-acting barrel pumps.
"	"	3	125	3	"	"	5	2 1-2	
Double Acting.....	"	5	125	5	"	"	4 1-2	2 1-2	
" "	"	3 1-4	125	3 1-4	"	"	4 1-2	2	
" " Barrel	Barrel	2	125	2	"	"	3 1-2	2 1-2	
O.K.		2	125	2	"	"	3 1-2	2 1-2	
Perfect	Barrel	2	125	2	"	Ball	3 1-2	2 1-2	
SPRAMOTOR COMPANY									
Duplex Power	Power	6 to 8	200	6 to 8	50 strokes	Ball	6	2	All inside plunger packed, single acting pumps with no stuffing box and one or two brass cylinders.
Duplex	Hand	4 to 5	125	4 to 5	30 strokes	"	6	2	
Field and Grape...	Traction	5 to 8	125	5 to 8	"	"	6	2	
Sprapainter	Barrel	2 to 3	125	2 to 3	"	"	3.5 - 5.5	2 1-2	
Spramotor No. 0 ..	"	1 to 1 3-8	125	1 to 1 3-8	"	"	4 1-2	1 3-8	
" " 1 ..	"	3 to 4	125	3 to 4	"	"	4 to 5	3	
" " 2 ..	"	4 to 6	125	4 to 7	"	"	4.5 - 5.5	3 1-2	
Knapsack	Knapsack	1-2	125	1-2	"	"	3 1-2	1 1-4	
Wm. STAHL SPRAYER COMPANY									
Excelsior No. 27...	Hand	4	125	3 1-2 to 4	30 strokes	Poppet	2 3-4	2 1-2	Double acting stuffing box type.
" " 22...	Barrel	2 to 3	125	2 to 3	"	"	3 to 5	2 1-2	Similar to Gould's barrel pumps in construction
" " 24...	"	1 1-1	125	1 1-2	"	"	4	2	
" " 29...	"	2 to 3	126	1 1-2 to 2	"	"	3	2 1-2	

In conclusion let me set forth a *few things which should be remembered.*

1 Choose a machine that has the factors of *simplicity*, *durability* and *capacity* and the *efficiency* of the machine will be unquestioned.

2 Cost is another question. A few dollars higher in price usually means *better quality* and "the best is the cheapest in the end."

3 *Clean* up your *machine* and *accessories each time* when you are *through spraying.*

4 *Keep* your machine in *good trim*, all *bolts* and *bearings tight*, *plunger packed*, etc.

5 Use *good* oil and *plenty* of it.

6 If something goes wrong and fails to work *find out* what the *trouble* is, before you *change any adjustments. Changing adjustments* without knowing *why* only *means more trouble.*

7 *Results* depend upon *thorough work* and the *use* of *good standard brands* of spraying materials.

8 *Study* your *machine* and your *problem* and *persevere.*

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